PB-239 596

TOWLINE LAKE, ONEIDA COUNTY, WISCONSIN

Pacific Northwest Environmental Research Laboratory

Prepared for:

National Environmental Research Center
Wisconsin National Guard
Wisconsin Department of Natural Resources

October 1974

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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

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REPORT
ON
TOWNLINE LAKE
ONEIDA COUNTY
WISCONSIN
EPA REGION V
WORKING PAPER No. 53

WITH THE COOPERATION OF THE
WISCONSIN DEPARTMENT OF NATURAL RESOURCES
AND THE
WISCONSIN NATIONAL GUARD

OCTOBER, 1974

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monito ng [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Wisconsin Department of Natural Resources for professional involvement and to the Wisconsin National Guard for conduct of the tributary sampling phase of the Survey.

Francis H. Schraufnagel, Acting Assistant Director, and Joseph R. Ball of the Bureau of Water Quality, and Donald R. Winter, Lake Rehabilitation Program, provided invaluable lake documentation and counsel during the Survey. Central Office and District Office personnel of the Department of Natural Resources reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper series.

Major General James J. Lison, Jr., the Adjutant General of Wisconsin, and Project Officer CW-4 Donald D. Erickson, who directed the volunteer efforts of the Wisconsin National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

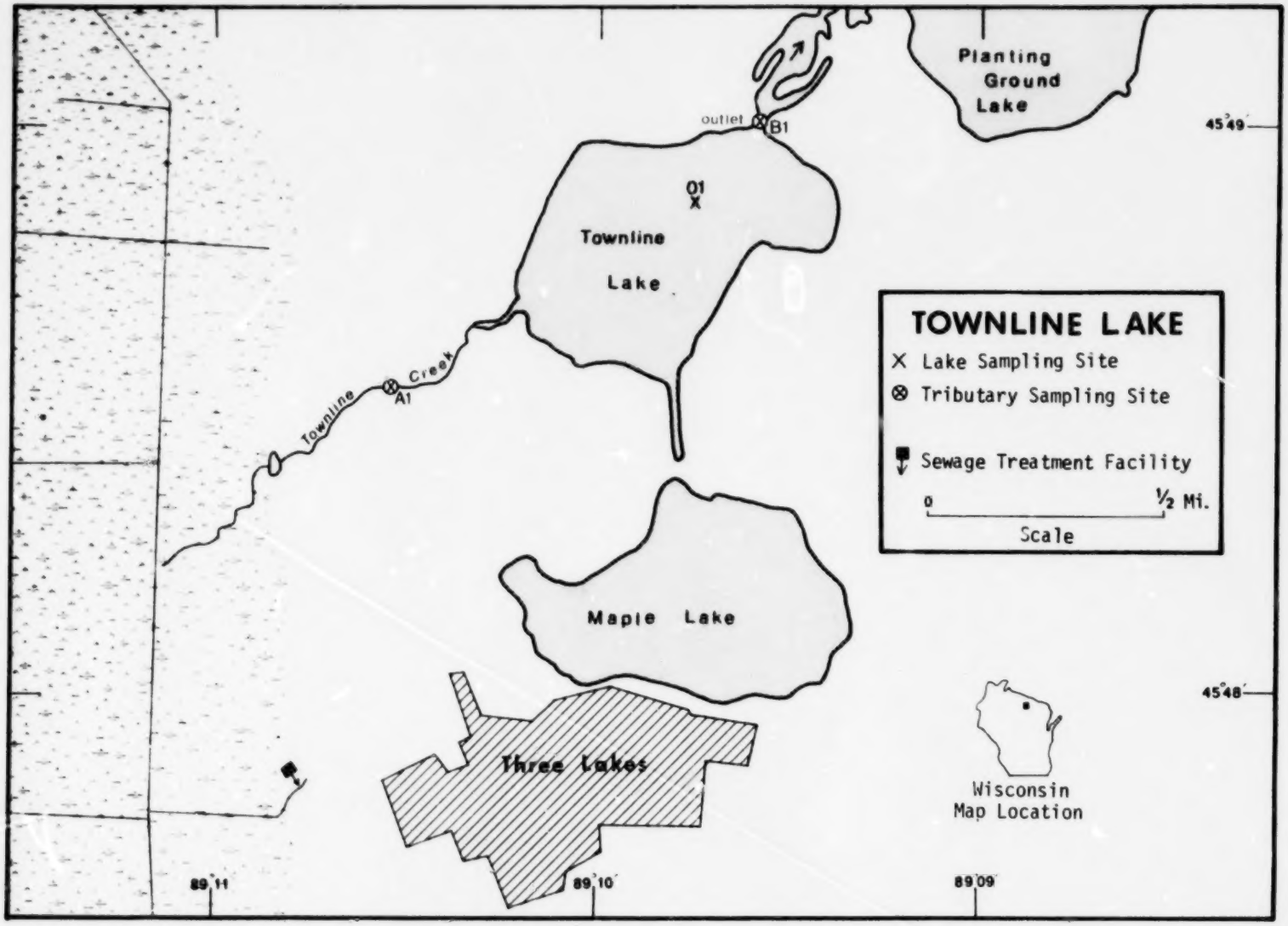
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF WISCONSIN

LAKE NAME	COUNTY
Altoona	Eau Claire
Beaver Dam	Barron
Beaver Dam	Dodge
Big Eau Pleine	Marathon
Browns	Racine
Butte des Morts	Winnebago
Butternut	Price, Ashland
Castle Rock Flowage	Juneau
Como	Walworth
Crystal	Vilas
Delavan	Walworth
Eau Claire	Eau Claire
Elk	Price
Geneva	Walworth
Grand	Green Lake
Green	Green Lake
Kegonsa	Dane
Koshkonong	Jefferson, Rock, Dane
Lac La Belle	Waukesha
Long	Price
Middle	Walworth
Nagawicka	Waukesha
Oconomowoc	Waukesha
Okauchee	Waukesha
Petenwell Flowage	Juneau
Pewaukee	Waukesha
Pigeon	Waupaca
Pine	Waukesha
Poygan	Winnebago, Waushara
Rock	Jefferson
Rome Pond	Jefferson, Waukesha
Round	Waupaca
Shawano	Shawano

LAKE NAME	COUNTY
Sinnissippi	Dodge
Swan	Columbia
Tainter	Dunn
Tichigan	Racine
Townline	Oneida
Trout	Vilas
Wapogassett	Polk
Wausau	Marathon
Willow	Oneida
Winnebago	Winnebago, Fond Du Lac, Calumet
Wisconsin	Columbia
Wissota	Chippewa
Yellow	Burnett


Planting Ground Lake
outlet
B1
45°49'
01
Townline Lake
Townline Creek
A1
TOWNLINE LAKE
X Lake Sampling Site
⊗ Tributary Sampling Site
Sewage Treatment Facility
0
½ Mi.
Scale
Maple Lake
45°48'
Three Lakes
Wisconsin Map Location
89°11'
89°10'
89°09'

TOWNLINE LAKE

STORET NO. 5548

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Townline Lake is eutrophic. However, as far as is known, there have been few, if any, reports of nuisance conditions in the lake.

B. Rate-Limiting Nutrient:

Lake data indicate that Townline Lake was nitrogen limited at all depths during all sampling periods, except for the 15-foot June sample. Contrarily, the results of the algal assay indicate phosphorus limitation. However, there was a considerable loss of nitrogen and phosphorus in the sample before the assay was begun, and the results are not considered to be indicative of the lake condition (see discussion, page 8).

C. Nutrient Controllability:

1. Point sources--It is calculated that during the sampling year, Townline Lake received a total phosphorus load at a rate about three times that proposed by Vollenweider (in press) as "dangerous"; i.e., a eutrophic rate (see page 14). Of that loading, it is estimated that the Three Lakes Sanitary District contributed nearly 54%.

In view of the high loading rates and the relatively high nutrient concentrations in the lake, it would be expected that

growths of algae or aquatic weeds or both would be a common occurrence. However, apparently this is not the case. It is concluded, therefore, that some factor or combination of factors, other than nitrogen and phosphorus, is limiting the primary productivity of the lake and that removal of phosphorus at the Three Lakes Sanitary District facility at this time probably would not appreciably enhance the recreational uses of the lake.

2. Non-point sources (see page 14)--The estimated phosphorus export of Townline Creek during the sampling year was quite high (212 lbs/mi^2/yr) as compared to the phosphorus exports of tributaries to nearby Willow Reservoir (ca. 65 lbs/mi^2/yr). This may have been due to underestimation of the Three Lakes Sanitary District phosphorus contribution, but the extensive marsh along the course of Townline Creek could have been the source.

II. INTRODUCTION

Townline Lake is located in a sparsely populated area in the Upper Wisconsin River basin of north central Wisconsin. The area was glaciated, and the topography is largely level outwash plains and moraines. Much of the area is forested, although cranberry bogs are common.

Townline Lake is in a popular summer resort area, and recreational activity is said to be the base of the local economy. The primary recreational uses of the lake are boating and fishing. Game fish present include muskellunge, walleyes, largemouth bass, and panfish. Commercial boating facilities are available; and although most of the shoreline is privately owned, public access is provided.

Other uses of the lake include flood control and low-flow augmentation.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry:

1. Surface area: 150 acres.
2. Mean depth: 12.4 feet.
3. Maximum depth: 30 feet.
4. Volume: 1,855 acre/feet.
5. Mean hydraulic retention time: 253 days.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area*	Mean flow*
Townline Creek	3.3 mi^2	2.7 cfs
Minor tributaries & immediate drainage -	1.2 mi^2	1.0 cfs
Totals	4.5 mi^2	3.7 cfs

2

2. Outlet -

Unnamed Creek	4.7 mi^2**	3.7 cfs

C. Precipitation†:

1. Year of sampling: 37.9 inches.
2. Mean annual: 32.3 inches.

---

* Drainage areas are accurate within ±0.5%; mean daily flows are accurate within ±40%; mean monthly flows are accurate within ±35%; and normalized monthly flows are accurate within ±35%.

** Includes area of lake.

† See Working Paper No. 1, "Survey Methods".

IV. LAKE WATER QUALITY SUMMARY

Townline Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from one station on the lake and from a number of depths at the station (see map, page vi). During each visit, a single depth-integrated (near bottom to surface) sample was collected for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was collected for algal assays. Also each time, a depth-integrated sample was collected from the station for chlorophyll a analysis. The maximum depth sampled was 15 feet.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (11/04/72)		
Temperature (Cent.)	3.5	3.5	3.5	3.5
Dissolved oxygen (mg/l)	9.2	9.2	9.2	9.2
Conductivity (µmhos)	90	90	90	90
pH (units)	6.5	6.5	6.5	6.5
Alkalinity (mg/l)	18	19	19	20
Total P (mg/l)	0.109	0.110	0.109	0.111
Dissolved P (mg/l)	0.049	0.049	0.049	0.050
NO_2 + NO_3 (mg/l)	0.180	0.197	0.200	0.210
Ammonia (mg/l)	0.240	0.260	0.270	0.270
		ALL VALUES		
Secchi disc (inches)	24	32	36	36

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
06/25/72	1. Anabaena	326
	2. Ankistrodesmus	167
	3. Dinobryon	149
	4. Synedra	113
	5. Oocystis	54
	Other genera	104
	Total	913
08/23/72	1. Synedra	687
	2. Mallomonas	223
	3. Cryptomonas	193
	4. Ankistrodesmus	181
	5. Dinobryon	157
	Other genera	277
	Total	1,718
11/04/72	1. Phacus	778
	2. Melosira	588
	3. Synedra	515
	4. Dinobryon	208
	5. Oscillatoria	199
	Other genera	434
	Total	2,722

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
06/25/72	01	6.8
08/23/72	01	4.5
11/04/72	01	4.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.014	0.231	3.8
0.006 P	0.020	0.231	5.7
0.012 P	0.026	0.231	8.0
0.024 P	0.038	0.231	8.2
0.060 P	0.074	0.231	7.8
0.060 P + 10.0 N	0.074	10.231	33.9
10.0 N	0.014	10.231	2.6

2. Discussion -

Although the assay results indicate phosphorus limitation, a significant loss of nitrogen and phosphorus occurred between the time the sample was collected and the time the assay was begun. Therefore, the results are considered unreliable. Whether the loss occurred during shipment or storage of the sample is not known, but there was a 55% loss of dissolved phosphorus and a 49% loss of inorganic nitrogen.

The lake data indicate that Townline Lake was nitrogen limited. Except for the 15-foot June sample in which the nitrogen to phosphorus ratio was 19 to 1, all samples had N/P ratios of 10/1 or less; i.e., nitrogen limitation would be expected.

D. Trophic Condition:

As far as is known, no particular aquatic nuisance problems have been reported for Townline Lake; nonetheless, Survey data indicate that Townline Lake is eutrophic. Of the 44 Wisconsin lakes on which sampling was completed, 27 had less mean total phosphorus, 26 had less mean dissolved phosphorus, and 23 had less mean inorganic nitrogen. While only 9 of the lakes had less mean chlorophyll a, 29 had greater Secchi disc transparency (Survey limnologists noted high turbidity and strong humic coloration in the lake on all sampling visits, and phytoplankton may have been somewhat light inhibited).

Dissolved oxygen was depleted at the 15-foot level in June and in August.

V. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the Wisconsin National Guard collected a monthly near-surface grab sample from each of the tributary sites indicated on the map (page vi), except for the high runoff months of April and May when two samples were collected. Sampling was begun in September, 1972, and was completed in August, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Wisconsin District Office of the U. S. Geological Survey for the tributary sites nearest the lake.

In this report, tributary nutrient loads were calculated using mean concentrations and mean flows. Nutrient loadings for "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were calculated using the mean nutrient loading rate ($lbs/mi^2/yr$) for Willow Reservoir, a reservoir in Oneida County having similar drainage characteristics.

The nutrient loads attributed to Townline Creek in the following loading tables are those measured at station A-1 minus the loads attributed to the Three Lake Sanitary District treatment facility.

The community of Three Lakes submitted a number of effluent samples, but too few flow data were provided to permit loading calculations. Nutrient loads were estimated on the basis of population served and annual per capita contributions of 2.5 lbs of phosphorus and 7.5 lbs of nitrogen.

Of the 10 dwellings along the lake shore, half were assumed to be permanent residences, and the eight resorts were each assumed to be equivalent to 10 dwellings. Loadings were then determined as given in Working Paper No. 1, "Survey Methods".

A. Waste Sources:

1. Known municipal -

Name	Pop. Served	Treatment	Mean Flow (mgd)	Receiving Water
Three Lakes S. D.	400*	Primary	0.040**	Townline Creek

2. Industrial - Unknown

* Schraufnagel, 1974.
** Estimated at 100 gal/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Townline Creek	700	37.4
b. Minor tributaries & immediate drainage (non-point load) -	90	4.8
c. Known municipal STP's -		
Three Lakes	1,000	53.5
d. Septic tanks* -	60	3.2
e. Industrial - None known	-	-
f. Direct precipitation** -	20	1.1
Total	1,870	100.0

2. Outputs -

Lake outlet - Unnamed Creek 890

3. Net annual P accumulation - 980 pounds

* Ten dwellings and 8 resorts on lakeshore; see Working Paper No. 1.
** Estimated; see Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Townline Creek	4,180	33.2
b. Minor tributaries & immediate drainage (non-point load) -	1,780	14.1
c. Known municipal STP's -		
Three Lakes	3,000	23.8
d. Septic tanks* -	2,190	17.4
e. Industrial - None known	-	-
f. Direct precipitation** -	1,450	11.5
Total	12,600	100.0

2. Outputs -

Lake outlet - Unnamed Creek 11,440

3. Net annual N accumulation - 1,060 pounds

* Ten dwellings and 8 resorts on lakeshore; see Working Paper No. 1.
** Estimated; see Worling Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs $P/mi^2/yr$	lbs $N/mi^2/yr$
Townline Creek	212	1,267

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	12.5	5.9	84.0	7.1
grams/m^2/yr	1.40	0.66	9.4	0.8

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Townline Lake:

"Dangerous" (eutrophic rate)	0.46
"Permissible" (oligotrophic rate)	0.23

VI. LITERATURE REVIEWED

Anonymous, 1972. Wisconsin lakes. Publ. #218-72, Dept. of Natural Resources, Madison.

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McKersie, Jerome R., Robert M. Krill, William Doyle, and Larry Maltbey, 1970. Upper Wisconsin River pollution investigation survey. Dept. of Natural Resources, Madison.

Pomes, James N., 1974. Personal communication (location of Three Lakes S. D. outfall). Three Lakes Sanitary District, Three Lakes.

Schraufnagel, Francis H., 1974. Personal communication (population served by Three Rivers S. D.; drainage characteristics). Dept. of Natural Resources, Madison.

Vollenweider, Richard A., (in press). Input-output models. Schweiz A. Hydrol.

VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR WISCONSIN 9/30/74

LAKE CODE 5548 TOWN LINE LAKE

TOTAL DRAINAGE AREA OF LAKE 4.68

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
5548A1	3.26	1.60	1.60	2.40	4.60	3.70	4.90	2.30	1.60	2.20	2.60	2.90	1.90	2.69
554881	4.68	1.53	2.41	3.83	7.44	5.80	6.67	3.06	2.5[illegible]	3.28	3.17	3.28	1.97	3.74
5548ZZ	1.42	0.42	0.68	1.10	2.10	1.60	1.90	0.84		0.93	0.88	0.93	0.55	1.05

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 4.68
SUM OF SUB-DRAINAGE AREAS = 4.68

TOTAL FLOW IN = 44.92
TOTAL FLOW OUT = 44.95

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
5548A1	9	72	1.30	24	1.20				
	10	72	1.80						
	11	72	1.50						
	12	72	0.60	9	0.70				
	1	73	0.90						
	2	73	1.30	9	1.30				
	3	73	11.00	10	4.30				
	4	73	26.00	7	24.00	28	22.00		
	5	73	14.00	5	19.00	19	10.00		
	6	73	5.90	17	5.20				
	7	73	0.70	28	0.60				
	8	73	0.90	26	1.00				
554881	9	72	2.00	24	1.90				
	10	72	2.70						
	11	72	2.40						
	12	72	1.00	9	1.10				
	1	73	1.00						
	2	73	1.50	10	1.50				
	3	73	12.00	10	5.00				
	4	73	19.00	7	18.00	28	16.00		
	5	73	9.40	5	13.00	19	6.90		
	6	73	4.00	17	3.60				
	7	73	0.40	28	0.40				
	8	73	0.60	26	0.60				
5548ZZ	9	72	0.50	24	0.40				
	10	72	0.60						
	11	72	0.50						
	12	72	0.20	9	0.30				
	1	73	0.20						
	2	73	0.40	9	0.40	10	0.40		
	3	73	3.60	10	1.30				
	4	73	10.00	7	9.00	28	8.30		
	5	73	4.10	5	5.90	19	3.00		
	6	73	1.80	17	1.50				
	7	73	0.10	28	0.10				
	8	73	0.20	26	0.20				

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/09/30

554801
45 48 48.0 089 09 48.0
TOWN LINE LAKE
55 WISCONSIN

11EPALES
3

2111202
0018 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/25	11 30	0000	17.0	8.6	36	100	7.50	29	0.040	0.050	0.042	0.030
	11 30	0005	17.0									
	11 30	0010	16.0									
	11 30	0015	11.0	0.0		115	6.70	31	0.030	0.580	0.053	0.032
72/08/23	11 00	0000			36	99	6.70	27	0.040	0.150	0.082	0.045
	11 00	0004	20.3	6.0		94	6.80	26	0.030	0.060	0.074	0.040
	11 00	0015	16.4	0.2		120	6.40	42	0.080	0.020	0.068	0.024
72/11/04	09 40	0000			24	90	6.50	18	0.210	0.270	0.109	0.049
	09 40	0004	3.5	9.2		90	6.50	19	0.180	0.240	0.111	0.050
	09 40	0010	3.5	9.2		90	6.50	20	0.200	0.270	0.109	0.049

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/25	11 30	0000	6.8J
72/08/23	11 00	0000	4.5J
72/11/04	09 40	0000	4.1J

J* VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 74/10/02

5548A1 LS5548A1
45 48 30.0 089 10 30.0
UNNAMED TRIBUTARY
55 15 THREE LAKES
I/TOWN LINE LAKE
CO HWY 26 & 32 THREE LAKES STP MARSHLAND
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	09	15	0.177	1.500	0.051	0.005K	0.390
72/11/05			0.046	1.150	0.034	0.105	0.140
72/12/09			0.310	1.310	0.370	0.120	0.260
73/01/13				0.940	0.064	0.050	0.130
73/02/09			0.357	2.000	1.040	0.320	0.460
73/03/10	11	00	0.154	1.600	0.830	0.350	0.450
73/04/07	11	00	0.091	0.710	0.039	0.100	0.130
73/04/28	08	30	0.054	0.600	0.016	0.066	0.090
73/05/05	14	45	0.027	0.630	0.015	0.052	0.070
73/05/19	17	00	0.023	0.630	0.013	0.054	0.082
73/06/17	11	30	0.154	1.920	0.064		0.620
73/07/29	17	30	0.260	1.150	0.190	0.130	0.290
73/08/26	08	30	0.105	8.700	3.400	0.530	1.050

16

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/10/02

554881 LS554881
45 49 00.0 089 09 30.0
UNNAMED TRIBUTARY
55 15 THREE LAKES
O/TOWN LINE LAKE
TRAIL NW SIDE LAKE TO OUTLET
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	09 30		0.084	1.350	0.059	0.005K	0.054
72/11/05			0.168	0.960	0.100	0.069	0.113
72/12/09			0.220	2.100	0.083	0.066	0.260
73/01/13			0.410	1.760	0.765	0.281	0.550
73/02/10			0.350	1.000	0.144	0.080	0.115
73/03/10	13 00		0.350	0.650	0.140	0.042	0.055
73/04/07	13 30		0.198	2.200	0.083	0.058	0.100
73/04/28	16 00		0.105	2.200	0.056	0.032	0.070
73/05/05	08 45		0.110	1.800	0.052	0.036	0.080
73/05/19	17 15		0.010K	2.310	0.056	0.019	0.070
73/06/17	14 00		0.126	0.690	0.009	0.008	0.040
73/07/28	10 30		0.017	0.660	0.030	0.012	0.043
73/08/26	15 48		0.010K	0.580	0.035	0.019	0.045

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/04/10

554850 PR554850 P000700
45 48 30.0 089 10 00.0
VLG OF THREE LAKES
55 15 THREE LAKES
T/TOWN LINE LAKE
UNNAMED TRIB
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/07/11	10 00		0.130	42.000	17.000	6.200	9.100	0.079	0.058
73/08/07	08 00								
CP(T)-								0.092	0.080
73/08/07	16 00								
73/12/19	11 00								
CP(T)-			1.050	28.000	9.400	3.990	6.000		
73/12/19	16 00								
74/03/07	09 30		2.240	14.000	2.800	2.200	3.400	0.080	
74/03/18	09 00		2.240	11.000	1.900	1.880	2.700		
74/04/15	11 00		2.150	19.000	4.700	3.900	7.000		
74/06/14	12 00		0.420	34.000	13.000	6.400	11.300		
74/07/16	10 00		0.040	25.500	9.200	5.600	8.100		